

CLAIMS

1. An ultrasonic probe including an insert section which is to be inserted in to a body cavity organ of a subject and a handle section which couples with the insert section, wherein a plurality of vibrator elements are disposed at the tip of the insert section around entire 360 degree outer circumference thereof and in the handle section a connection change over switch is disposed which successively changes over electrical connection of a predetermined number of vibrator elements among the plurality of vibrator elements to be connected with a predetermined number of ultrasonic wave transmission and reception channels for transmitting and receiving ultrasonic wave signals in an ultrasonic diagnostic apparatus main body.

2. An ultrasonic diagnostic apparatus including an ultrasonic probe having an insert section which is to be inserted in to a body cavity organ of a subject and a handle section which couples with the insert section and an ultrasonic diagnostic apparatus main body having a predetermined number of ultrasonic wave transmission and reception channels for transmitting and receiving ultrasonic wave signals to the ultrasonic probe and an ultrasonic wave image computing circuit for computing ultrasonic images based on the ultrasonic wave transmission and reception signals from the predetermined number of ultrasonic wave transmission

and reception channels, wherein a plurality of vibrator elements are disposed at the tip of the insert section around entire 360 degree outer circumference of the ultrasonic probe, in the handle section a connection
5 change over switch is disposed which successively changes over electrical connection of a predetermined number of vibrator elements among the plurality of vibrator elements to be connected with the predetermined number of ultrasonic wave transmission
10 and reception channels and the ultrasonic wave image computing circuit in the ultrasonic diagnostic apparatus main body includes an ultrasonic tomogram computing circuit and an ultrasonic blood flow image computing circuit.

15 3. An ultrasonic diagnostic apparatus according to claim 2, wherein the connection change over switch which successively connects the predetermined number of the ultrasonic wave transmission and reception channels with the predetermined number of vibrator
20 elements is ON and OFF controlled so that the delay time of ultrasonic wave signal transmitted and received by a vibrator element located at the center of an array of the predetermined number of the vibrator elements being connected at respective times assumes the maximum
25 and the delay times of ultrasonic wave signals transmitted and received are distributed in a symmetric manner with reference to the center.

4. An ultrasonic diagnostic apparatus according to claim 3, wherein the connection change over switch is constituted in such a manner that the respective plurality of the vibrator elements are connectable with
5 any one of the predetermined number of ultrasonic wave transmission and reception channels and the delay times of the ultrasonic wave signals transmitted and received from the predetermined number of ultrasonic wave transmission and reception channels are set unchanged.

10 5. An ultrasonic diagnostic apparatus according to claim 3, wherein the connection change over switch is constituted in such a manner that each of the predetermined number of the ultrasonic wave transmission and reception channels is connectable with
15 a predetermined number of the vibrator elements and the delay times of the ultrasonic wave signals transmitted and received from the predetermined number of ultrasonic wave transmission and reception channels are set changeable at respective times.

20 6. An ultrasonic diagnostic apparatus according to claim 2, wherein the predetermined number of the vibrator elements connected to the predetermined number of the ultrasonic wave transmission and reception channels at respective times by the connection change
25 over switch is one which covers about 90 degrees over the outer circumferential face at the tip of the insert section.

7. An ultrasonic diagnostic apparatus according to claim 2, wherein the ultrasonic wave image computing circuit further includes an image selection circuit.

8. An ultrasonic diagnostic apparatus according to claim 2, wherein the predetermined number of the vibrator elements connected to the predetermined number of the ultrasonic wave transmission and reception channels at respective times by the connection change over switch is variable depending on the depth of a portion of a body cavity organ for image taking.

9. An ultrasonic diagnostic apparatus according to claim 2, wherein the ultrasonic diagnostic apparatus main body further includes an image display unit which displays an ultrasonic tomogram and an ultrasonic blood flow image based on outputs from the ultrasonic tomogram computing circuit and the ultrasonic blood flow image computing circuit.

10. An ultrasonic diagnostic apparatus according to claim 4, wherein the successive change over of the electrical connection by the connection change over switch of the predetermined number of the ultrasonic wave transmission and reception channels with the array of the predetermined number of vibrator elements is performed by repeating an operation of disconnecting the rear most vibrator element among the array of the predetermined number of the vibrator elements in the scanning direction by the ultrasonic wave signals with

an ultrasonic wave transmission and reception channel and of newly connecting a vibrator element adjacent to the top vibrator element among the array of the predetermined number of the vibrator elements in the scanning direction by the ultrasonic wave signals with the ultrasonic wave transmission and reception channel of which connection with the rear most vibrator element was disconnected immediately before.

11. An ultrasonic diagnostic apparatus according to claim 5, wherein the successive change over of the electrical connection by the connection change over switch of the predetermined number of the ultrasonic wave transmission and reception channels with the array of the predetermined number of vibrator elements is performed by repeating an operation of disconnecting the rear most vibrator element among the array of the predetermined number of the vibrator elements in the scanning direction by the ultrasonic wave signals with an ultrasonic wave transmission and reception channel and of newly connecting a vibrator element adjacent to the top vibrator element among the array of the predetermined number of the vibrator elements in the scanning direction by the ultrasonic wave signals with the ultrasonic wave transmission and reception channel of which connection with the rear most vibrator element was disconnected immediately before.

12. An ultrasonic diagnostic apparatus according

to claim 10, wherein the successive change over of the electrical connection by the connection change over switch of the predetermined number of the ultrasonic wave transmission and reception channels with the array
5 of the predetermined number of vibrator elements is performed by shifting the scanning direction by the ultrasonic wave signals over the entire 360 degree circumference.

13. An ultrasonic diagnostic apparatus according
10 to claim 11, wherein the successive change over of the electrical connection by the connection change over switch of the predetermined number of the ultrasonic wave transmission and reception channels with the array of the predetermined number of vibrator elements is
15 performed by shifting the scanning direction by the ultrasonic wave signals over the entire 360 degree circumference.

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